

Beaufort Sea Planning Area (Alaska) – Province Summary

2006 Oil and Gas Assessment

Introduction

The Beaufort Sea assessment province extends from the 3-mile limit of State of Alaska waters northward to the 500 m isobath, and from 156° W longitude (roughly north of the village of Barrow) to the Canadian maritime boundary (figs. 1 and 2). The 500 m isobath was adopted as a reference marker approximating the present practical limit for petroleum development in Beaufort Sea. Beyond the 500 m isobath, extreme water depths and ice conditions essentially preclude exploration and development using existing technologies.

The Beaufort shelf assessment province is in many ways simply a direct geological extension of (onshore) northern Alaska and includes the offshore Arctic platform. It is comprised of a series of basins and intervening highs formed during a complex history of rifting and continental break-up north of Alaska and folding and thrusting on the south and east (Craig et al., 1985).

Exploration History

Northern Alaska discovered resources are scattered among more than 30 oil and gas fields, but most resources occur in the several oil fields in the Prudhoe Bay area (figs. 2 and 3). Many, but not all, of the key oil-source and reservoir sequences of northern Alaska (highlighted in fig. 4) extend directly into offshore assessment provinces. For this reason, and because of the abundance of untested potential traps in the offshore, the Beaufort and adjacent Chukchi shelf assessment provinces are considered high potential areas.

Petroleum exploration of Alaska's North Slope (that area between the Brooks Range and the Beaufort Sea coast) began

with the establishment of the Naval Petroleum Reserve No. 4 (NPR-4) in 1923. As a result of drilling from 1944 to 1953, small oil fields were discovered at Umiat, Simpson, and Fish Creek. Gas fields were discovered at Gubik, South Barrow, Meade, Square Lake, Oumalik, and Wolf Creek. The South Barrow gas field supplied fuel to the Naval Arctic Research Lab for a number of years. The field still provides gas to the village of Barrow. In 1975, federally-funded exploration resumed in NPR-4 and continued for 7 years. This drilling program found gas fields and some oil shows at East Barrow and Walakpa, both of which provide gas for the village of Barrow. NPR-4 became the National Petroleum Reserve in Alaska (NPRA) in 1977 when the Department of the Interior received jurisdiction of the area.

The State of Alaska held the first competitive lease sale on the North Slope in late 1964. The State held a second competitive lease sale in 1965 that included the Prudhoe Bay structure. Atlantic Richfield Company and Humble Oil announced the discovery of the Prudhoe Bay field in 1968 after drilling the Prudhoe Bay State #1 well. Other oil fields discovered during the flurry of exploration activity following the Prudhoe Bay discovery include Kuparuk (1969), West Sak (1969), Milne Point (1970), Flaxman Island (1975), Point Thomson (1977), and Sag Delta-Duck Island (1978), (later called the Endicott field).

Petroleum exploration of the Beaufort shelf assessment province began with a joint State of Alaska—Federal offshore lease sale in December 1979 (Sale BF). Eight additional lease sales have been held since

(Sales 71, 87, 97, 124, 144, 170, 186, and 195). A total of 36 wells have been drilled on the Beaufort OCS leases. These wells led to a number of OCS oil discoveries: At Tern Island (Liberty field) oil was discovered in the Mississippian Kekiktuk formation of the Endicott group. At Seal Island (Northstar field) oil was discovered in the Triassic Ivishak Formation. The Hammerhead and Kuvlum wells discovered oil in Cenozoic Brookian clastics. Two wells at the Sandpiper prospect encountered significant quantities of gas and condensate in Sadlerochit sands. The Phoenix and Antares wells encountered minor amounts of oil in the Sag River formation. Mukluk and Mars wells encountered minor amounts of oil in the Sadlerochit Gp. The Galahad well encountered minor amounts of gas and an oil show in numerous Cenozoic sands, and the McCovey well showed oil in core samples from the Brookian turbidite sequence.

Production History

At present, the only commercial hydrocarbon production in federal Beaufort Sea waters is from the Northstar field, 5 miles north of Prudhoe Bay. The Northstar field contains 205 million barrels recoverable oil reserves (Mmbo) and 450 Billion cubic feet (Bcf) gas.¹ It began production in 2001 and to date produced over 90 Mmbo. In addition, BP is analyzing the economic viability of the 150 (Mmbo) Liberty field with anticipated production by 2111 - 2112 (Petroleum News, 2005).

There are seven large producing oil fields on State lands, the best known being the Prudhoe Bay field with total recoverable reserves (including satellite fields) of over 14 billion barrels of oil (Bbo) and 23,000 Bcf gas. Other producing fields are the

Kuparuk field (including West Sak, Tabasco, Tarn, and Meltwater) with 3.54 Bbo and 1,150 Bcf gas, the Milne Point Unit (including Milne Pt, Sag River and Schrader Bluff fields) with 627 Mmbo and 14 Bcf gas, the Duck Island Unit (Endicott field and Sag Delta North) with 583 Mmbo and 843 Bcf gas, the Point McIntyre field (including Lisburne, Niakuk, North Prudhoe Bay, Pt McIntyre, and West Beach fields) with 912 Mmbo and 1,526 Bcf gas, and the Colville River Unit (Alpine field and satellites) with 695 Mmbo and 400 Bcf gas. Relatively small additional quantities of oil (6 Mmbo) are produced from the Badami field east of Prudhoe Bay. Three gas fields (South Barrow, East Barrow, and Walakpa) near the village of Barrow are producing gas for local community consumption. As yet undeveloped on shore fields includes the Point Thomson with projected reserves of 243 Mmbo and 8,000 Bcf gas.

Regional Geology of Northern Alaska and the Arctic Alaska Offshore

Northern Alaska and the adjacent continental shelves are underlain by sedimentary rocks that represent one fragment of a large basin that once was continuous across a single "super-continent". This super-continent is now represented by several independent continental masses separated by the Arctic oceanic basin (Chukotka, northern Alaska, northern Canada, and perhaps others; Jackson and Gunnarsson, 1990; Embry, 1990). This "supercontinent" broke up about 100 Ma (million years ago) into fragments that were dispersed by expansion of the Arctic oceanic basin. The former assemblage of the now-dispersed continental masses is suggested by strong similarities between rock sequences deposited in a large, continuous basin that extended across the super-continent before the breakup event. In fact, the rocks that record the pre-breakup

¹ Unless otherwise cited all reserve estimates are from the State of Alaska Division of Oil and Gas 2006 annual report

basin in northern Alaska are generally grouped under the term "Ellesmerian sequence" because of their striking resemblance to rocks of the same age exposed on Ellesmere Island in northern Canada near Greenland, now 2,100 km distant (Grantz and others, 1975). Correlative rocks are found on several circum-Arctic continents, and the Ellesmerian sequence as most broadly defined ranges in age from about 360 to 175 Ma (fig. 4).

In many areas of the Arctic, Ellesmerian rocks or correlative sequences rest upon a group of highly deformed rocks of Devonian and older ages. In northern Alaska and northern Canada, these rocks are assigned to a group of rocks called the "Franklinian" sequence. Franklinian rocks host oil and gas deposits in northern Canada (Stuart Smith and Wenekers, 1977). Play 1, Undeformed Pre-Mississippian Basement play, is associated with Franklinian rocks.

In the Arctic, the breakup of the old supercontinent that hosted deposition of Ellesmerian rocks is marked by younger sedimentary deposits that are peculiar to the rift zones along which the old supercontinent fragmented. In this report, these deposits are referred to as either the "Rift" sequence (terminology of Craig and others, 1985), or the roughly correlative and comparable "Beaufortian" sequence described by Hubbard and others (1987) along the Beaufort margin. These rocks range from about 175 to 115 Ma in age (fig. 4).

Continental fragmentation and dispersal began a phase of active expansive growth of the Arctic oceanic basin at mid-ocean rifts or spreading centers. These movements inevitably caused collisions between dispersing breakup fragments and outlying independent continental masses or volcanic arcs. These collisions in turn caused uplifts of new mountain systems with

complementary basins that received sedimentary debris shed from the mountains. In northern Alaska, the rocks that record this event are termed the "Brookian" sequence, in deference to their obvious ties to the Brooks Range of northern Alaska. Rocks correlative to the Brookian sequence of Alaska are found on all of the circum-Arctic continents, but can be quite varied owing to their independent origins in many different types of basins. Brookian rocks in northern Alaska range in age from about 115 Ma to the present (fig. 4).

Reservoir Rocks

The reservoirs for the commercial fields are thick sandstones primarily of the Ellesmerian and Beaufortian (here, Rift) sequences. The reservoirs at Prudhoe Bay (main and North Prudhoe pools), Northstar, and Endicott (Ivishak pool) fields are in the quartz-rich sandstones of the Permian to Triassic Sadlerochit Group. These rocks are the primary focus for play 6, the Upper Ellesmerian play in the Beaufort shelf assessment province. The reservoirs at the Kuparuk, Point McIntyre, Milne Point, and Prudhoe Bay (Niakuk and West Beach pools) fields are in marine sandstones of the Cretaceous Kuparuk Formation, part of the Beaufortian sequence, and the Alpine field reservoirs are late-Jurassic upper Kingak sands. These rocks are the focus for play 7, the Rift play in the Beaufort shelf assessment province. The Endicott and Liberty field reservoirs are in the fluvial sandstones of the Mississippian Endicott Group. These rocks are the focus of play 4, the Endicott play on Beaufort shelf.

Carbonates of the Mississippian Lisburne Group (part of the Ellesmerian sequence) form the reservoirs for the Lisburne pool of Prudhoe Bay field. These carbonates are the focus for play 5, the Lisburne play in the Beaufort offshore. Pre-Mississippian carbonates near Point

Thomson have yielded hydrocarbons in well tests and are the basis for play 1, the Undeformed Pre-Mississippian play.

Brookian sequence reservoirs occur in delta and prodelta sandstones of the Nanushuk Group, Torok Formation, Canning Formation, and Sagavanirktok Formation. They are the focus of the Brookian plays (plays 8 to 16). These sands are generally thinner than reservoir sandstones in the underlying Ellesmerian or Beaufortian sequences. In the western part of the Beaufort shelf assessment province, the Nanushuk Group and Colville Group both have poor quality reservoirs (low porosity and permeability) due to the high clay content of the sandstones. Reservoir quality in the Torok Formation is poor nearly everywhere due to the fine-grained and mud-rich nature of the sediments supplied to the shelf break by the Nanushuk delta system. Sandstones with excellent reservoir qualities occur within the Sagavanirktok Formation in the central North Slope and reservoir-quality sandstones probably extend offshore into Beaufort shelf. Sagavanirktok discoveries in this area (West Sak and Ugnu pools) contain heavy hydrocarbons which are difficult to extract. Recent technological advances including extended reach drilling have proven successful in advancing the production of these viscous hydrocarbons on-shore.

Reservoirs in the Canning Formation consist mostly of turbidite sands enclosed within thick shale sequences, all deposited in mostly submarine fan environments. The Badami field east of Prudhoe Bay tested this play with marginal success limited primarily by reservoir compartmentalization. This play was also tested by the McCovey well which in this interval encountered low permeability turbidite sands.

In the eastern part of the Beaufort shelf assessment province, in the Brookian

Foldbelt play (play 16), offshore wells found only thin, scarce reservoir-quality sands. However, this play is only sparsely tested. To the east in Canada, wells encountered excellent reservoir-quality sandstones in Brookian sequences of Tertiary age (Dixon and others, 1992).

Source Rocks

Four source rock sequences are the primary sources for all commercial hydrocarbons on the North Slope (Bird, 1994, Peters and others, 2006). These are: The Hue-GRZ, Pebble Shale, Kingak, and Shublik. The Shublik Formation is the primary Ellesmerian source rock for commercial hydrocarbons (oil) on the North Slope (Bird, 1994). Shales in the basal Kingak formation also have source potential and may provide some hydrocarbons to the North Slope oil fields. The Hue-GRZ shale is a significant source on the eastern North Slope where the Ellesmerian sources have been truncated and is thought to contribute significantly to the Prudhoe Bay oil (Petroleum News June 11, 2006). The Pebble Shale also has oil source potential. The only known Brookian oil source rocks are the Hue Shale, and possibly, the shales of the Torok Formation and the Colville Group. While the Hue Shale contains oil-prone kerogen, the Torok Formation and Colville Group source rocks are primarily gas prone.

Play Definition

Hydrocarbon resources are contained in 14 geologic plays in the Beaufort shelf assessment province. The locations of these plays are shown the individual play summaries (links to play summaries provided on [page 7](#), this report). Plays in the Beaufort Sea assessment province are primarily defined by stratigraphic unit ([fig. 4](#)). The “Undeformed Pre-Mississippian Basement” (play 1) is in the Franklinian

sequence. The Ellesmerian sequence is split into the “Endicott” (play 4), “Lisburne” (play 5), and “Upper Ellesmerian” (play 6) plays. The “Rift” play (play 7) is in the Beaufortian sequence.

The Brookian sequence is divided into plays first on the basis of stratigraphy and then further subdivided on the basis of structural setting. The Brookian sequence is a system of overlapping, northeast-prograding deltas with sandstone reservoirs formed in both topset and prodelta facies within the delta system. Potential hydrocarbon traps within the Brookian sequence are therefore first grouped into either “topset” plays or “prodelta (turbidite)” plays. These two play groups are then further separated into “east” and “west” play groups that recognize important lateral stratigraphic changes within the Brookian sequence². The Brookian play groups, topset versus prodelta, and east versus west, are further divided into “unstructured” plays which occur on the Arctic platform south of the hinge line fault zone and “faulted” plays which occur from the hinge line fault zone north to the province’s northern border.

In the eastern part of the Beaufort shelf assessment province, a regional foldbelt intersects the hinge line fault zone to produce numerous complex structures. Here, we do not distinguish “topset” versus “prodelta” facies within the Brookian sequence, and, the structured area is assessed as simply the Brookian Foldbelt play (play 16).

²*In the western part of the province (“western” Brookian plays), the topset plays are in the Nanushuk and Colville Groups, and the turbidite plays are in the Torok Formation. In the central part of the province (“eastern” Brookian plays), the topset plays are in the Sagavanirktok Formation, and the turbidite plays are in the Canning Formation.*

Resource Endowment

Table 1 summarizes the 2006 assessment results by commodity for the Beaufort Sea, with detailed results by commodity reported in table 4. Table 2 shows the conditional sizes of the 10 largest pools in the Beaufort Sea assessment province. Beaufort Sea assessment results are shown graphically in figure 5. Table 3 lists the risked, undiscovered technically recoverable oil and gas resources by commodity for the 14 individual plays.

Beaufort Sea OCS Planning Area, 2006 Assessment, Undiscovered Technically-Recoverable Oil & Gas			
Assessment Results as of November 2005			
Resource Commodity (Units)	Resources *		
	F95	Mean	F05
BOE (Mmboe)	527	13,142	36,078
Total Gas (Tcfg)	0.649	27.645	72.178
Total Liquids (Mmbo)	412	8,224	23,235
Free Gas** (Tcfg)	0.322	23.792	60.965
Solution Gas (Tcfg)	0.328	3.853	11.213
Oil (Mmbo)	405	7,224	20,625
Condensate (Mmbo)	7	999	2,611

* Risked, Technically-Recoverable
 ** Free Gas Includes Gas Cap and Non-Associated Gas
 F95 = 95% chance that resources will equal or exceed the given quantity
 F05 = 5% chance that resources will equal or exceed the given quantity
 BOE = total hydrocarbon energy, expressed in barrels-of-oil-equivalent, where 1 barrel of oil = 5,620 cubic feet of natural gas
 Mmb = millions of barrels
 Tcf = trillions of cubic feet

Table 1

As shown in table 3, four plays have mean resources of over 1 billion barrels of oil equivalent (Boe). These are; play 16 Brookian Foldbelt (3.645 Bboe), play 12-Brookian Faulted Eastern Topset (2.831

Bboe), play 6 *Upper Ellesmerian* (1,660 Bboe), and play 7 *Rift* (1,157 Bboe). In play 12, 63% of the resources are derived from gas and 42% of the liquid resource is condensate (natural gas liquids). The other three large-resource plays are primarily oil plays with relatively low condensate values. Five other plays have undiscovered resources of greater than 300 million barrels, including: play 14 - Brookian Faulted Eastern Turbidite (941 Mmboe), play 13 - Brookian Unstructured Eastern Topset (639 Mmboe), play 8 - Brookian Faulted Western Topset (614 Mmboe), play 9 - Brookian Unstructured Western Topset (475 Mmboe), and play 4 - Endicott (354 Mmboe). Play 14 is largely a gas play with natural gas comprising 74% of the resource. Play 8 is a mixed play with natural gas comprising 61% of the resource. The others are oil plays.

Beaufort Sea OCS Planning Area, Alaska, 2006 Assessment, Conditional BOE Sizes of Ten Largest Pools				
Assessment Results as of November 2005				
Pool Rank	Play Number	BOE Resources * (Mmboe)		
		F95	Mean	F05
1	16	289	2144	6044
2	12	296	1602	4553
3	7	77	838	3287
4	6	129	834	2612
5	16	178	795	2287
6	12	167	672	1591
7	8	34	542	2164
8	14	75	531	1705
9	16	129	437	1106
10	9	23	423	1490

* Conditional, Technically-Recoverable, Millions of Barrels Energy-Equivalent (Mmboe), from "PSRK.out" file
 F95 = 95% chance that resources will equal or exceed the given quantity
 F05 = 5% chance that resources will equal or exceed the given quantity
 BOE = total hydrocarbon energy, expressed in barrels-of-oil-equivalent, where 1 barrel of oil = 5,620 cubic feet of natural gas

Table 2

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Links to Summaries for Individual Plays and Appended Items

[Play 1 \(Undeformed Pre-Mississippian Basement\), Beaufort Sea Planning Area, Assessment Summary](#)
[Play 4 \(Endicott\), Beaufort Sea Planning Area, Assessment Summary](#)
[Play 5 \(Lisburne\), Beaufort Sea Planning Area, Assessment Summary](#)
[Play 6 \(Upper Ellesmerian\), Beaufort Sea Planning Area, Assessment Summary](#)
[Play 7 \(Rift\), Beaufort Sea Planning Area, Assessment Summary](#)
[Play 8 \(Brookian Faulted Western Topset\), Beaufort Sea Planning Area, Assessment Summary](#)
[Play 9 \(Brookian Unstructured Western Topset\), Beaufort Sea Planning Area, Assessment Summary](#)
[Play 10 \(Brookian Faulted Western Turbidite\), Beaufort Sea Planning Area, Assessment Summary](#)
[Play 11 \(Brookian Unstructured Western Turbidite\), Beaufort Sea Planning Area, Assessment Summary](#)
[Play 12 \(Brookian Faulted Eastern Topset\), Beaufort Sea Planning Area, Assessment Summary](#)
[Play 13 \(Brookian Unstructured Eastern Topset\), Beaufort Sea Planning Area, Assessment Summary](#)
[Play 14 \(Brookian Faulted Eastern Turbidite\), Beaufort Sea Planning Area, Assessment Summary](#)
[Play 15 \(Brookian Unstructured Eastern Turbidite\), Beaufort Sea Planning Area, Assessment Summary](#)
[Play 16 \(Brookian Foldbelt\), Beaufort Sea Planning Area, Assessment Summary](#)

[Beaufort Plays-Assessment Results by Commodity \(Excel Format\)](#)
[Beaufort Plays-Input Data Tables \(Excel Format\)](#)
[Beaufort Plays-Pool Size Models \(Txt Format\)](#)
[Beaufort Plays-Simulation Pools-Statistics \(Excel Format\)](#)

2006 Assessment Results for Beaufort Sea OCS Planning Area

Risked, Undiscovered, Technically Recoverable Oil and Gas Resources, as of November 2005

Play Number	Play Name	BOE Resources (Mmbo)			Oil Resources (Mmbo)			Gas-Condensate Liquid Resources (Mmbo)			Free* Gas Resources (Tcfg)			Solution Gas Resources (Tcfg)			Total Liquid Resources (Mmbo)			Total Gas Resources (Tcfg)		
		F95	Mean	F05	F95	Mean	F05	F95	Mean	F05	F95	Mean	F05	F95	Mean	F05	F95	Mean	F05	F95	Mean	F05
1	Undeformed Pre-Mississippian Basement	0	31	117	0	15	56	0	1	4	0.000	0.066	0.260	0.000	0.016	0.060	0	16	60	0.000	0.083	0.320
4	Endicott	46	354	1,076	32	255	780	1	6	16	0.038	0.251	0.722	0.032	0.273	0.850	33	261	796	0.070	0.524	1.572
5	Lisburne	0	179	864	0	138	684	0	1	5	0.000	0.071	0.296	0.000	0.153	0.688	0	139	689	0.000	0.224	0.983
6	Upper Ellesmerian	366	1,660	3,891	270	1,236	2,893	4	18	37	0.240	0.955	1.996	0.274	1.327	3.399	275	1,254	2,930	0.514	2.282	5.395
7	Rift	0	1,157	3,296	0	773	2,385	0	27	56	0.000	1.153	2.190	0.000	0.850	2.614	0	801	2,441	0.000	2.002	4.804
8	Brookian Faulted Western Topset	0	614	2,234	0	152	672	0	90	312	0.000	2.056	6.883	0.000	0.034	0.144	0	242	983	0.000	2.090	7.027
9	Brookian Unstructured Western Topset	0	475	1,786	0	373	1,410	0	17	67	0.000	0.390	1.423	0.000	0.082	0.316	0	390	1,477	0.000	0.473	1.739
10	Brookian Faulted Western Turbidite	0	232	815	0	17	48	0	42	151	0.000	0.955	3.415	0.000	0.012	0.042	0	60	200	0.000	0.967	3.457
11	Brookian Unstructured Western Turbidite	0	218	777	0	151	536	0	10	33	0.000	0.217	0.778	0.000	0.107	0.387	0	161	569	0.000	0.324	1.165
12	Brookian Faulted Eastern Topset	0	2,831	7,114	0	615	1,999	0	438	1,047	0.000	9.855	22.439	0.000	0.135	0.421	0	1,053	3,046	0.000	9.991	22.860
13	Brookian Unstructured Eastern Topset	116	639	1,575	102	570	1,422	2	9	19	0.043	0.211	0.449	0.022	0.126	0.309	104	579	1,440	0.065	0.336	0.758
14	Brookian Faulted Eastern Turbidite	0	941	2,354	0	65	144	0	175	438	0.000	3.892	9.842	0.000	0.046	0.120	0	240	581	0.000	3.938	9.962
15	Brookian Unstructured Eastern Turbidite	0	168	533	0	116	369	0	7	24	0.000	0.168	0.529	0.000	0.082	0.258	0	123	393	0.000	0.250	0.787
16	Brookian Foldbelt	0	3,645	9,647	0	2,748	7,228	0	157	401	0.000	3.552	9.743	0.000	0.609	1.605	0	2,905	7,628	0.000	4.161	11.348
Sum of All Plays**		527	13,142	36,078	405	7,224	20,625	7	999	2,611	0.322	23.792	60.965	0.328	3.853	11.213	412	8,224	23,235	0.649	27.645	72.178

* Free gas, occurring as gas caps associated with oil and as oil-free gas pools (non-associated gas).

** Values as reported out of Basin Level Analysis-Geologic Scenario aggregation module in GRASP, "Volume Ordered" aggregation option. Total liquids and total gas values were obtained by summing resource values for means and fractiles of component commodities. Play resource values are rounded and may not sum to totals reported from basin aggregation.

BOE, total energy, in millions of barrels (5,620 cubic feet of gas per barrel of oil, energy-equivalent); Mmbo, millions of barrels of oil or liquids; Tcfg, trillions of cubic feet of natural gas

Table 3. Summary of Beaufort Sea province assessment results for ultimate technically recoverable resources (UTRR), by play, 2006 assessment.

Province Resources - Technically Recoverable, Risked, By Product

Geological Resources Assessment Program-GRASP-Version 8.29.2005

The Current UAI AAAAAAB
 is for
 World Level - World Level Resources
 Country Level - UNITED STATES OF AMERICA
 Region Level - MMS - ALASKA REGION
Basin Level - BEAUFORT SEA

Basin Level Aggregation of Risked, Technically Recoverable Resources By Product (Province Aggregation ".out" file)

Volume Ordered (Play Aggregation Method)
 RandomSeed = 211327
 Number of Trials = 10000

Greater Than Percentage	BOE (Mboe)	Oil (Mbo)	Condensate (Mbc)	Solution Gas (Mmcf)	Free (Gas Cap & Nonassociated) Gas (Mmcf)
99	254,438.67	195,824.66	3,196.55	153,357.50	158,088.62
98	349,842.08	268,342.42	4,477.95	211,127.27	221,734.77
97	421,856.64	323,206.62	5,185.68	260,236.56	265,033.05
96	476,153.42	364,558.97	6,663.88	298,570.38	291,139.41
95	527,483.22	404,856.61	7,089.72	327,762.26	321,555.04
90	861,859.26	610,978.54	23,645.70	481,160.42	795,900.41
85	1,493,671.58	906,338.32	75,802.57	712,010.99	2,162,791.49
80	2,488,864.69	1,439,610.82	149,739.90	979,615.22	4,075,653.27
75	5,043,756.34	2,753,264.45	380,942.94	1,352,225.17	9,379,439.97
70	6,191,758.10	3,259,174.58	497,418.98	1,594,068.89	12,091,555.81
65	7,261,935.41	3,898,807.17	561,725.81	1,945,454.10	13,798,427.55
60	8,290,449.67	4,377,676.88	660,502.44	2,163,306.96	16,114,452.37
55	9,293,545.02	4,930,593.01	737,746.06	2,510,038.94	17,863,618.46
50	10,372,413.68	5,525,985.87	819,395.98	2,667,404.00	19,964,514.89
45	11,565,463.87	6,222,121.84	916,884.06	3,077,654.60	21,799,039.14
40	12,817,925.16	6,957,808.60	1,001,184.48	3,461,751.72	23,845,446.57
35	14,278,879.35	7,558,533.37	1,164,651.04	3,827,494.91	27,395,510.66
30	15,926,002.91	8,694,883.50	1,230,470.21	4,390,709.89	29,332,938.59
25	17,887,574.93	9,854,850.62	1,332,598.21	5,156,281.90	32,498,426.76
20	20,326,413.81	10,970,893.24	1,613,171.87	5,772,661.13	37,739,338.51
15	23,486,754.82	12,793,883.40	1,860,012.49	6,531,289.17	43,109,378.06
10	27,988,313.14	15,380,837.02	2,145,729.68	8,413,452.44	50,381,562.55
5	36,078,459.62	20,624,817.52	2,610,639.61	11,212,782.01	60,964,892.00
4	38,848,052.94	21,759,496.54	2,894,025.94	11,873,676.25	67,899,584.93
3	42,383,193.75	24,011,801.71	3,120,184.68	13,872,624.36	71,839,161.03
2	47,440,598.69	26,562,384.65	3,463,845.88	15,435,751.07	82,432,997.92
1	57,486,671.85	31,833,848.63	4,531,167.35	21,154,093.95	97,549,612.01
Mean	13,142,499.11	7,224,322.58	999,195.84	3,852,748.02	23,791,923.44
Rep	13,143,064.92	6,762,526.18	1,072,796.54	3,977,922.29	25,851,588.91
Min	0	0	0	0	0
Max	138,978,740.41	68,857,187.14	8,309,862.81	43,079,142.07	304,302,558.24

Table 4. Detailed report of ultimate technically recoverable resources (UTRR) by commodity, as reported in province aggregation file by GRASP computer model, 2006 assessment.

2006 Beaufort Sea Assessment Province and Alaska OCS

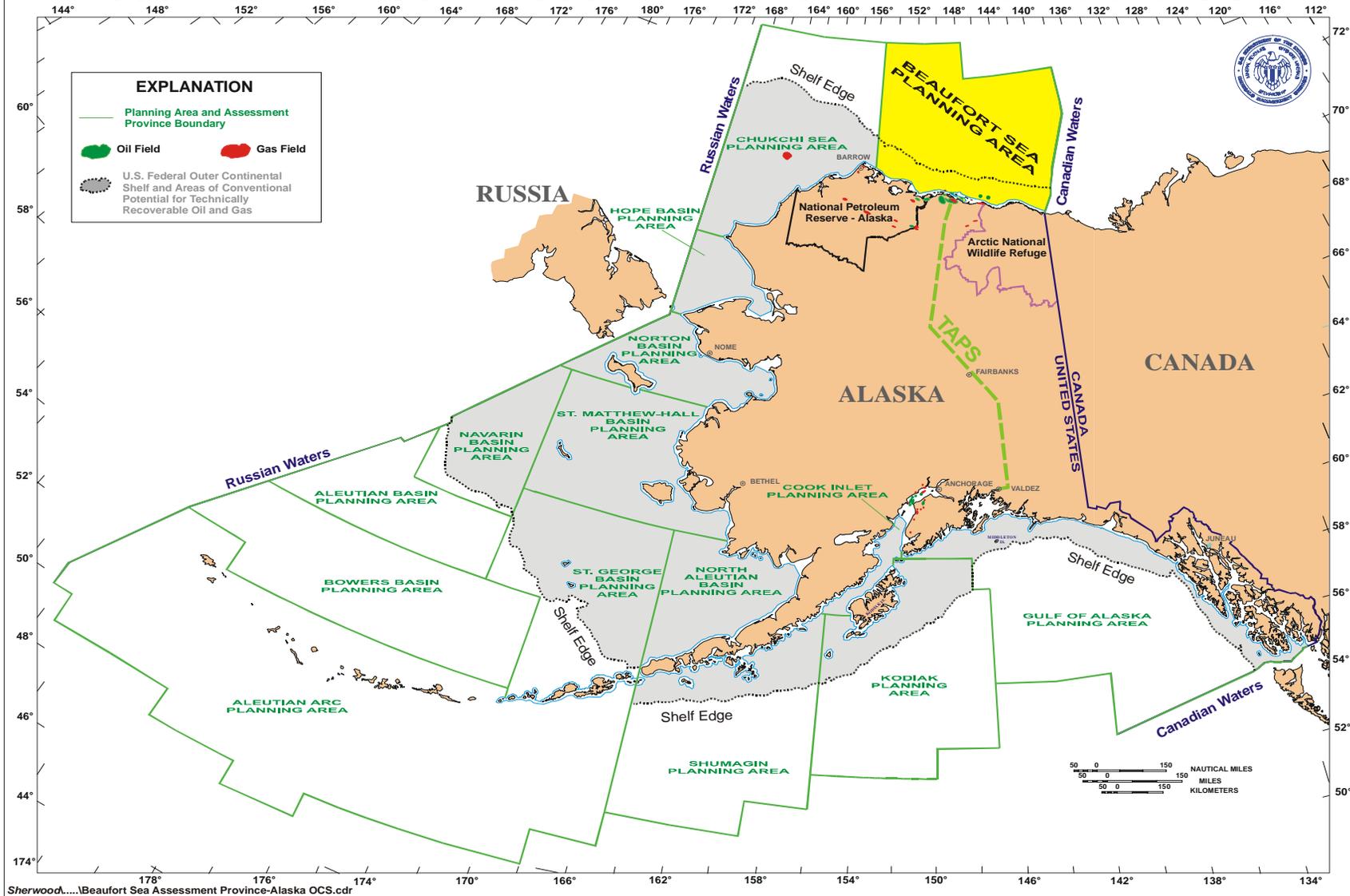
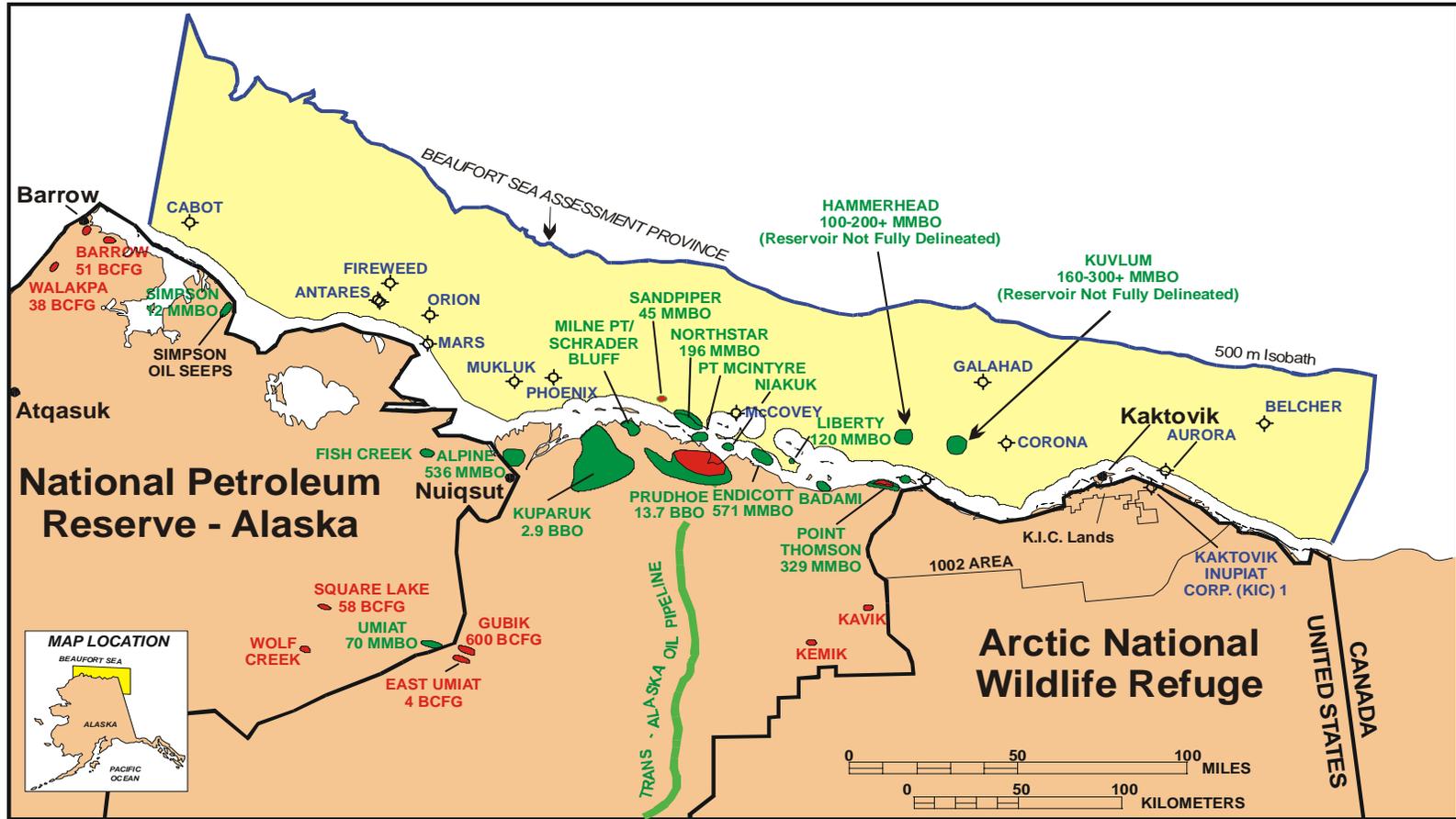


Figure 1. Location of Beaufort Sea Planning Area and 2006 assessment province.

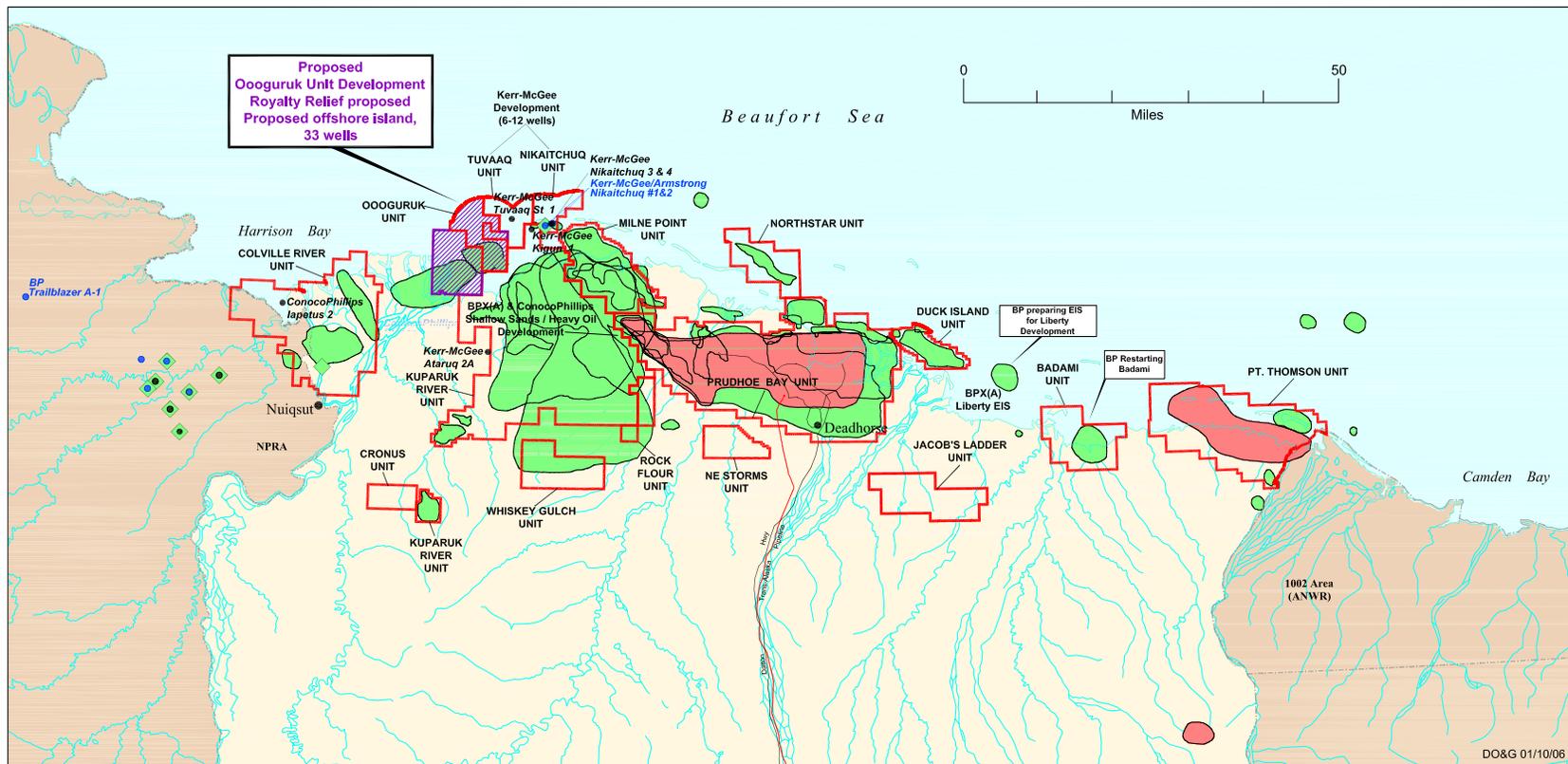
BEAUFORT SEA ASSESSMENT PROVINCE



EXPLANATION			
	EXPLORATION WELL, PLUGGED AND ABANDONED	MMBO	MILLIONS OF BARRELS OF OIL, RECOVERABLE
	OIL FIELD	BBO	BILLIONS OF BARRELS OF OIL, RECOVERABLE
	GAS FIELD	BCFG	BILLIONS OF CUBIC FEET OF GAS, RECOVERABLE
	UMIAT 70 MMBO	TCFG	TRILLIONS OF CUBIC FEET OF GAS, RECOVERABLE
	GUBIK 600 BCFG		Beaufort Sea Assessment Province

Sherwood...\Beaufort Assessment Province.cdr

Figure 2. Location of Beaufort Sea assessment province, with discovered fields and northern Alaska oil production infrastructure.



North Slope Oil & Gas Activity & Discoveries January 2006

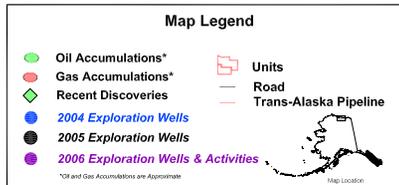
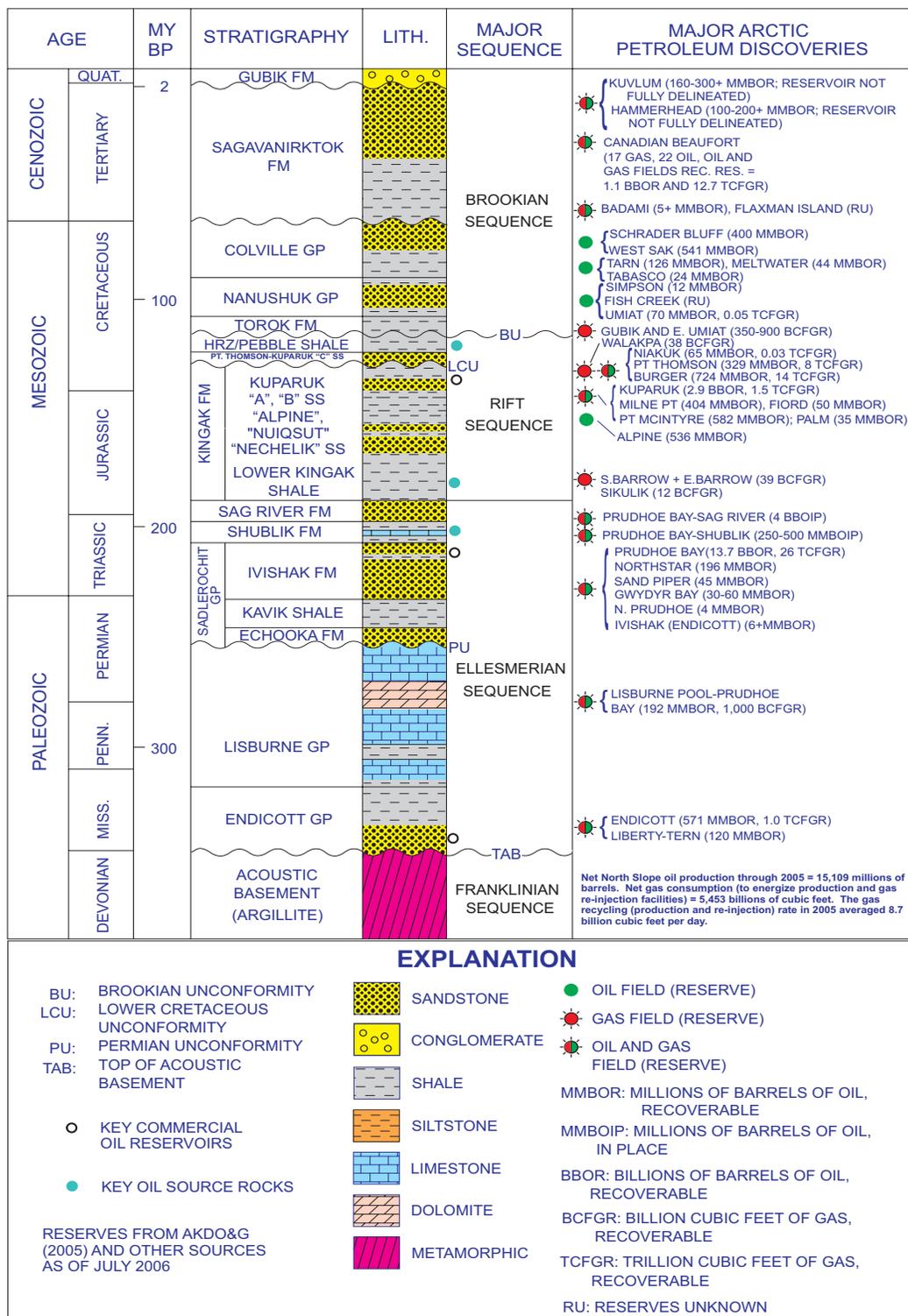


Figure 3. Northern Alaska fields, production units, and oil transportation infrastructure. Available in pdf (Adobe Acrobat) format from State of Alaska Division of Oil and Gas at: <http://www.dog.dnr.state.ak.us/oil/products/maps/northslope/northslope.htm>.

BEAUFORT SHELF AND NORTHERN ALASKA STRATIGRAPHIC COLUMN



Sherwood...Beaufort Sea Stratigraphic Column-2006.cdr

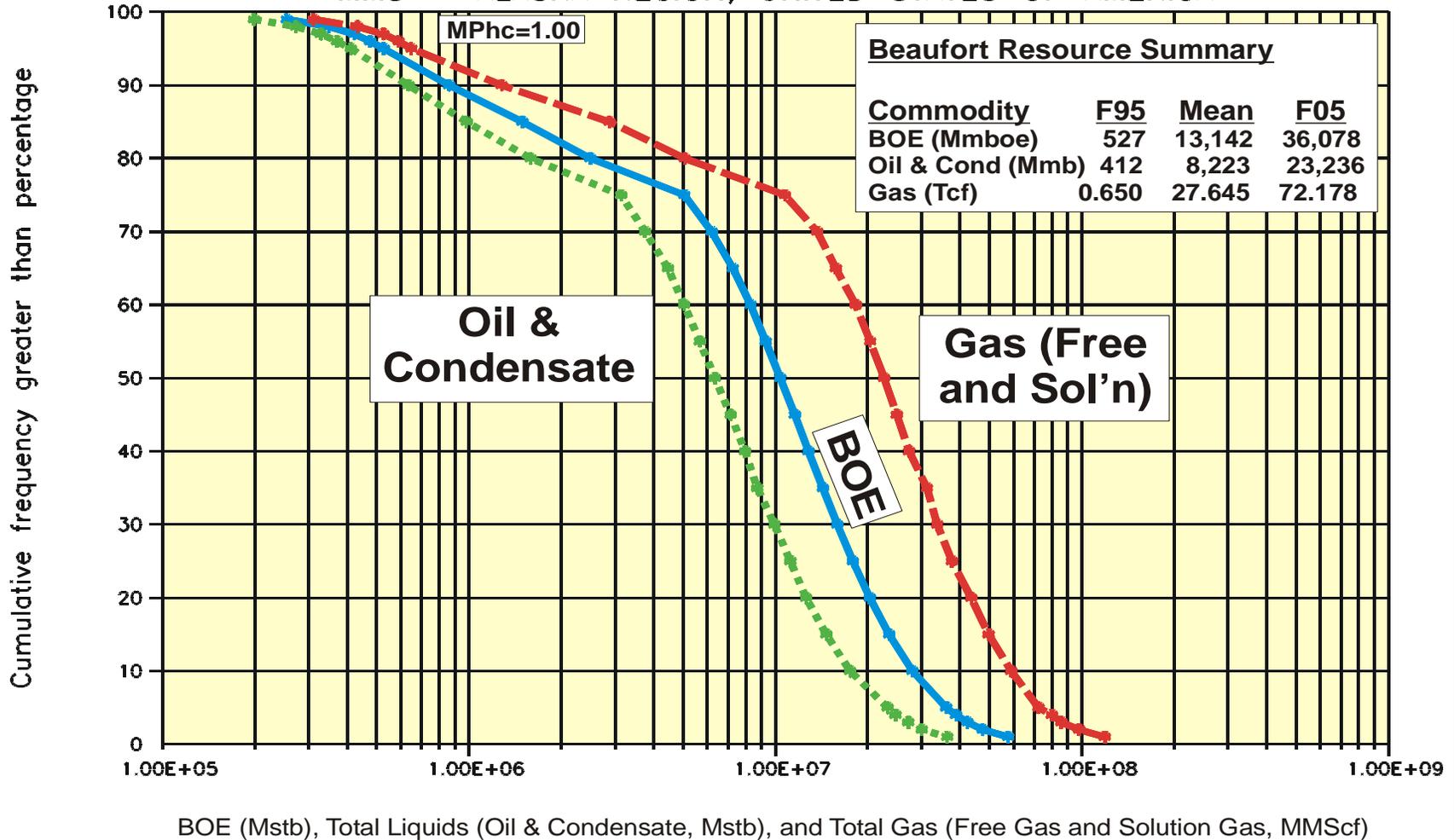
Figure 4. Stratigraphic column for Beaufort Sea assessment province and northern Alaska.

Oil & Condensate, BOE, and Gas Resources

(Risked, Undiscovered, Technically Recoverable)

BEAUFORT SHELF

MMS – ALASKA REGION, UNITED STATES OF AMERICA



SherwoodL...Beaufort-CumulativeGraph-BOE-Oil-Gas.cdr

Figure 5. Cumulative probability plot for undiscovered, technically recoverable oil and gas resources for Beaufort Sea Planning Area and assessment province, 2006 assessment.